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Montageanleitung / *Assembly Instructions*

Rotary encoder series 65

- Grundlegende Sicherheitshinweise
- Verwendungszweck
- Allgemeine Funktionsbeschreibung
- Mechanische Kenndaten
- Montage

- *Basic safety instructions*
- *Proper use*
- *General functional description*
- *Mechanical characteristics*
- *Mounting*

TR - ECE - BA - DGB - 0046 - 04 03/21/2012

Assembly Instructions

Absolute rotary encoder series 65

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Italic or **bold** font styles are used for the title of a document or are used for highlighting.

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Revision index

Revision	Date	Index
First release	10/25/2005	00
• Revision: -Modification of the standards	07/20/2009	01
• Integrated claw coupling and blind shaft added	06/09/2010	02
• -Modification of the warnings	08/04/2011	03
• CMx-65, IMx-65, IEx-65 and IOx-65 added	03/21/2012	04

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1 General

These Assembly Instructions are contained in the delivery package and include the following topics:

- General functional description
- Basic safety instructions with declaration of the proper use
- Mechanical characteristics
- Mounting

As the documentation is arranged in a modular structure, this Assembly Instructions are supplementary to other documentation, such as product datasheets, dimensional drawings, leaflets and interface-specific User Manuals etc.

1.1 Scope

These Assembly Instructions apply exclusively to the following measuring system models:

- CE-65, CEV-65, COV-65, CMV-65, IMV-65, IEV-65, IOV-65
- CS-65, CES-65, COS-65, CMS-65, IMS-65, IES-65, IOS-65
- CK-65, CEK-65, COK-65, CMK-65, IMK-65, IEK-65, IOK-65

The products are labeled with affixed nameplates and are components of a system.

The following documentation therefore also applies:

- the operator's operating instructions specific to the system,
- these Assembly Instructions
- and the interface-specific User Manual

1.2 EC Declaration of conformity

The measuring systems have been developed, designed and manufactured under observation of the applicable international and European standards and directives.

A corresponding declaration of conformity can be requested from TR-Electronic GmbH.

The manufacturer of the product, TR-Electronic GmbH in D-78647 Trossingen, operates a certified quality assurance system in accordance with ISO 9001.

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1.3 Abbreviations and definitions

CE, CEV	Absolute Encoder with optical scanning unit ≤ 15 bit resolution, Solid Shaft
COV	Absolute Encoder with optical scanning unit > 15 bit resolution, Solid Shaft
CMV	Absolute Encoder with magnetic scanning unit, Solid Shaft
IMV	Incremental Encoder with magnetic scanning unit, Solid Shaft
IEV	Incremental Encoder with optical scanning unit ≤ 15 bit resolution, Solid Shaft
IOV	Incremental Encoder with optical scanning unit > 15 bit resolution, Solid Shaft
CS, CES	Absolute Encoder with optical scanning unit ≤ 15 bit resolution, Blind Shaft
COS	Absolute Encoder with optical scanning unit > 15 bit resolution, Blind Shaft
CMS	Absolute Encoder with magnetic scanning unit, Blind Shaft
IMS	Incremental Encoder with magnetic scanning unit, Blind Shaft
IES	Incremental Encoder with optical scanning unit ≤ 15 bit resolution, Blind Shaft
IOS	Incremental Encoder with optical scanning unit > 15 bit resolution, Blind Shaft
CK, CEK	Absolute Encoder with optical scanning unit ≤ 15 bit resolution, Integrated Claw Coupling
COK	Absolute Encoder with optical scanning unit > 15 bit resolution, Integrated Claw Coupling
CMK	Absolute Encoder with magnetic scanning unit, Integrated Claw Coupling
IMK	Incremental Encoder with magnetic scanning unit, Integrated Claw Coupling
IEK	Incremental Encoder with optical scanning unit ≤ 15 bit resolution, Integrated Claw Coupling
IOK	Incremental Encoder with optical scanning unit > 15 bit resolution, Integrated Claw Coupling
EC	***E***uropean ***C***ommunity
EMC	***E***lectro ***M***agnetic ***C***ompatibility
ESD	***E***lectro ***S***tatic ***D***ischarge
IEC	***I***nternational ***E***lectrotechnical ***C***ommission
VDE	***V***erein ***D***eutscher ***E***lektrotechniker (German Electrotechnicians Association)

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1.4 General functional description

1.4.1 Absolute Encoder

In contrast to incremental measuring systems, the absolute measuring system provides the current position value instantaneously. If this measuring system is moved mechanically in the deactivated state, the current position can be read out directly as soon as the voltage supply is switched on again.
The TR absolute measuring systems can be supplied in Single-Turn or Multi-Turn versions depending on the type required.

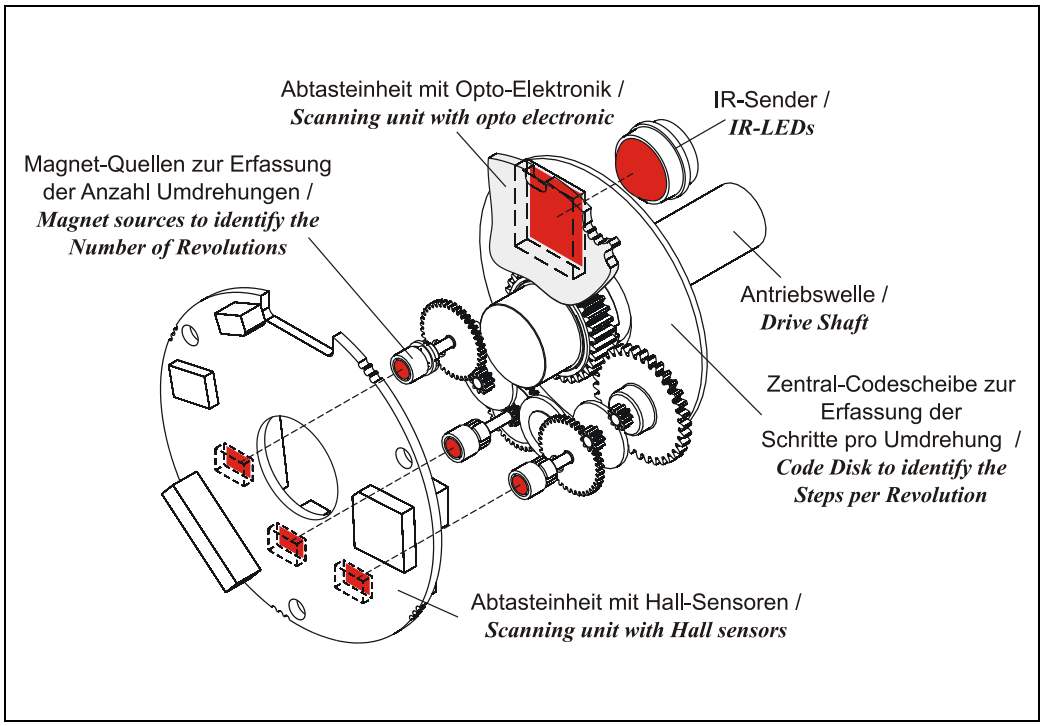
Single-Turn

This measuring system resolves **a single revolution or turn** of the drive shaft into measuring increments (e.g. 8192). The number of measuring increments per revolution is recorded and balanced via a code disk. This measured value is output via different interface modules depending on the type of interface used, and is repeated after each revolution.

Multi-Turn

Besides the angular positions per revolution, multi-turn measuring systems also record **multiple rotations or turns.** The drive shaft is connected to an internal reduction gear via which the number of revolutions is recorded.
In the case of the multi-turn measuring system, the measured value is thus composed of the **angular position** and the **Number of Revolutions**. The measured value is also balanced and output via different interface modules depending on the type of interface used.

Principle


Abtasteinheit mit Opto-Elektronik /
Scanning unit with opto electronic
IR-Sender /
IR-LEDs
Magnet-Quellen zur Erfassung der Anzahl Umdrehungen /
Magnet sources to identify the Number of Revolutions
Antriebswelle /
Drive Shaft
Zentral-Codescheibe zur Erfassung der Schritte pro Umdrehung /
Code Disk to identify the Steps per Revolution
Abtasteinheit mit Hall-Sensoren /
Scanning unit with Hall sensors

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1.4.2 Incremental Encoder

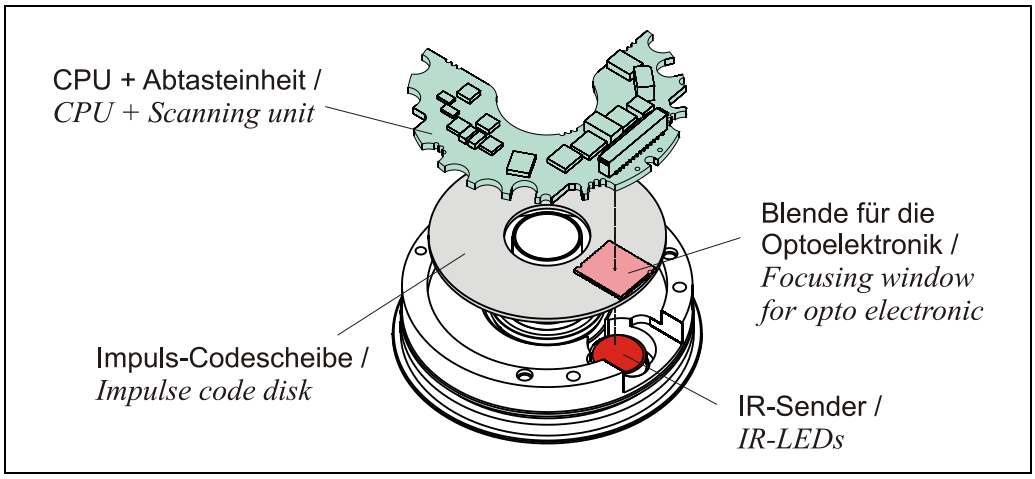
Angular increments are recorded via a pulse disk with a fixed number of cycles per revolution. A scanning unit with an integrated optoelectronic system generates electrical signals and emits pulses (measuring increments) which are pre-processed at trigger stages.

The resolution of the measuring system is defined via the number of light/dark segments (number of increments per revolution) on the pulse disk. For e.g. the measuring system outputs a signal sequence of 8192 pulses per revolution.

In order to evaluate the code sequence, a 2nd signal sequence with a 90° phase offset is output for the control.

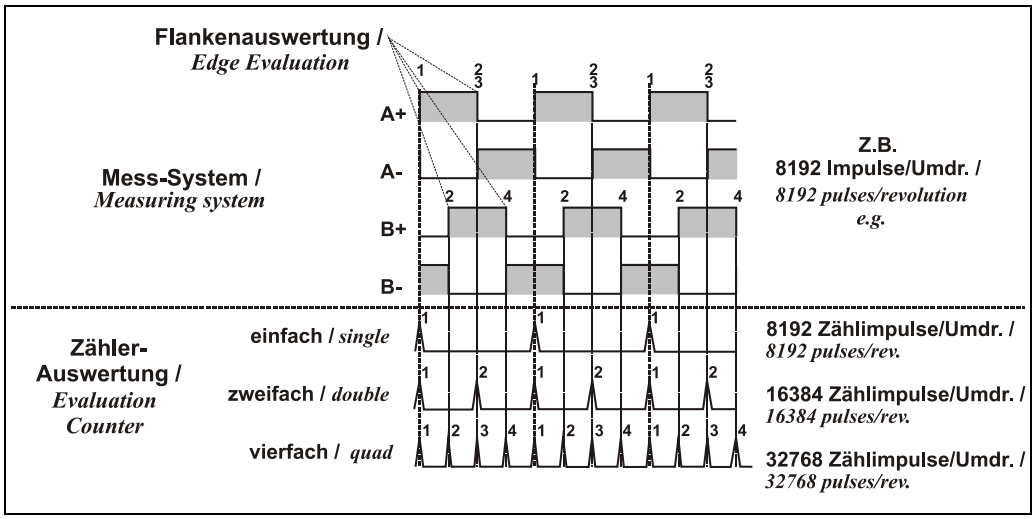
The counter of an external control system can be reset with an additional zero pulse in order to define the mechanical control reference point.

Principle



By a corresponding counter evaluation in the user electronics the measuring system resolution can be doubled or quadrupled electronically:

Reference signals not represented!



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2 Basic safety instructions

2.1 Definition of symbols and instructions

⚠ WARNING	means that death or serious injury can occur if the required precautions are not met.
⚠ CAUTION	means that minor injuries can occur if the required precautions are not met.
NOTICE	means that damage to property can occur if the required precautions are not met.
	indicates important information or features and application tips for the product used.
	means that appropriate ESD-protective measures are to be considered according to DIN EN 61340-5-1 supplementary sheet 1.

2.2 Obligation of the operator before start-up

As an electronic device the measuring system is subject to the regulations of the EMC Directive.

It is therefore only permitted to start up the measuring system if it has been established that the system/machine into which the measuring system is to be fitted satisfies the provisions of the EC EMC Directive, the harmonized standards, European standards or the corresponding national standards.

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2.3 General risks when using the product

The product, hereinafter referred to as **"the measuring system"**, is manufactured according to state-of-the-art technology and accepted safety rules. **Nevertheless, improper use can pose a danger to life and limb of the user or third parties, or lead to impairment of the measuring system or other property!**

Only use the measuring system in a technically faultless state, and only for its designated use, taking safety and hazard aspects into consideration, and observing these **Assembly Instructions** and the interface-specific **User Manual**! Faults which could threaten safety should be eliminated without delay!

2.4 Proper use

The measuring system is used to measure angular motion and to condition the measurement data for the subsequent control of industrial control processes.

Proper use also includes:

- observing all instructions in these Assembly Instructions and the interface-specific User Manual,
- observing the nameplate and any prohibition or instruction symbols on the measuring system,
- observing the enclosed documentation, e.g. product insert, connector configurations etc.
- observing the operating instructions from the machine or system manufacturer,
- operating the measuring system within the limit values specified in the technical data (Assembly Instructions / User Manual)

The following areas of use are especially forbidden:

- in environments where there is an explosive atmosphere
- for medical purposes

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Examples of typical fields of application at industrial process and control processes:

- Transfer machines
- Machine tools
- Gantry robots
- Assembly installations
- etc. ...
- Everywhere, where rotation or angular movements must be detected for evaluation

---

⚠ WARNING

NOTICE

- ***Where there is a danger of physical injury and damage to property arising from jumps in the position of the measuring system!***
  - As the measuring system **does not constitute a safety component**, a plausibility check of the measuring system values must be performed through the subsequent control system.
  - It is mandatory for the operator to integrate the measuring system into his own safety concept.

2.5 Warranty and liability

The General Terms and Conditions ("Allgemeine Geschäftsbedingungen") of TR-Electronic GmbH always apply. These are available to the operator with the Order Confirmation or when the contract is concluded at the latest. Warranty and liability claims in the case of personal injury or damage to property are excluded if they result from one or more of the following causes:

- Non-designated use of the measuring system.
- Improper assembly, installation, start-up and programming of the measuring system.
- Incorrectly undertaken work on the measuring system by unqualified personnel.
- Operation of the measuring system with technical defects.
- Mechanical or electrical modifications to the measuring systems undertaken autonomously.
- Repairs carried out autonomously.
- Third party interference and Acts of God.

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2.6 Organizational measures

- The Assembly Instructions must always be kept accessible at the place of use of the measuring system.
- In addition to the Assembly Instructions / User Manual, generally applicable legal and other binding accident prevention and environmental protection regulations are to be observed and must be mediated.
- The respective applicable national, local and system-specific provisions and requirements must be observed and mediated.
- The operator is obliged to inform personnel on special operating features and requirements.
- The personnel instructed to work with the measuring system must have read and understood the Assembly Instructions, especially the chapter “Basic safety instructions” prior to commencing work.
- The nameplate and any prohibition or instruction symbols applied on the measuring system must always be maintained in a legible state.
- Do not undertake any mechanical or electrical modifications on the measuring system, apart from those explicitly described in the Assembly Instructions or the User Manual.
- Repairs may only be undertaken by the manufacturer or a facility or person authorized by the manufacturer.

2.7 Personnel qualification; obligations

- All work on the measuring system must only be carried out by qualified personnel. Qualified personnel includes persons, who, through their training, experience and instruction, as well as their knowledge of the relevant standards, provisions, accident prevention regulations and operating conditions, have been authorized by the persons responsible for the system to carry out the required work and are able to recognize and avoid potential hazards.
- The definition of “Qualified Personnel” also includes an understanding of the standards VDE 0105-100 and IEC 364 (source: e.g. Beuth Verlag GmbH, VDE-Verlag GmbH).
- Define clear rules of responsibilities for the assembly, installation, start-up and operation. The obligation exists to provide supervision for trainee personnel !

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2.8 Safety informations

⚠ WARNING

NOTICE

- ***Destruction, damage or malfunctions of the measuring system and risk of physical injury!***
  - De-energize the system before carrying out wiring work or opening and closing electrical connections.
  - Do not carry out welding if the measuring system has already been wired up or is switched on.

NOTICE

- Ensure that the area around the assembly site is protected from corrosive media (acid, etc.).
- Avoid any shocks (e.g. hammer-blow) on the shaft while mounting.
- Do not open the measuring system.

The measuring system contains electrostatically endangered circuit elements and units which can be destroyed by an improper use.

- Contacts of the measuring system connection contacts with the fingers are to be avoided, or the appropriate ESD protective measures are to be applied.

- **Disposal**

  If disposal has to be undertaken after the lifespan of the device, the respective applicable country-specific regulations are to be observed.

- **Device designs**

  The technical details for customer-specific device designs, including connection technology, may differ from the designs described here and in the interface-specific User Manuals. In case of doubt, the manufacturer should be consulted, specifying the item number.

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3 Transportation / Storage

Notes on transportation

Do not drop the device or expose it to strong strokes!

Device contains an optical system.

Only use the original packaging!

The wrong packaging material can cause damage to the device during transportation.

Notes on transportation

Storage temperature: -30 to +80°C
Store in a dry place

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4 Technical data

The information specified in the Technical Data refers to the TR standard devices. The nameplate and any datasheet included with the device are therefore to be observed!
All dimensions are to be found in the customer-specific drawings.

4.1 Solid shaft

Environmental conditions

Vibration, DIN EN 60068-2-6: 1996 ..... ≤ 100 m/s^2, sine 50-2000 Hz
Shock, DIN EN 60068-2-27: 1995 ..... ≤ 1000 m/s^2, half-sine 11ms
EMC
- Immunity to disturbance, DIN EN 61000-6-2: 2006
- Transient emissions, DIN EN 61000-6-3: 2007

Working temperature ..... 0 °C…+60 °C, optional -20 °C…+70 °C
Storage temperature ..... -30 °C…+80 °C, dry
Relative humidity, DIN EN 60068-3-4: 2002 ..... 98 %, non condensing
Protection class, DIN EN 60529: 1991 ..... max. IP 65, dependent on the type of connector, or on the connection technology

Mechanical characteristics

Mechanically permissible speed ..... ≤ 6.000 min^{-1}
Shaft load, at the shaft end ..... ≤ 40 N axial, ≤ 60 N radial
Bearing life time ..... ≥ 3.9 * 10^{10} revolutions at
- Speed ..... ≤ 3.000 min^{-1}
- Operating temperature ..... ≤ 60 °C
- Shaft load, at the shaft end ..... ≤ 20 N axial, ≤ 30 N radial

Permissible angular acceleration ..... ≤ 10^4 rad/s^2
Moment of inertia ..... typically 2.5 * 10^{-6} kg m^2
Start-up torque at 20°C ..... typically 2 Ncm
Mass ..... typically 0.7 kg

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4.2 Blind shaft

Environmental conditions

Vibration, DIN EN 60068-2-6: 1996.....≤ 100 m/s^2, sine 50-2000 Hz
Shock, DIN EN 60068-2-27: 1995.....≤ 1000 m/s^2, half-sine 11ms
EMC
- Immunity to disturbance, DIN EN 61000-6-2: 2006
- Transient emissions, DIN EN 61000-6-3: 2007

Working temperature.....0 °C…+60 °C, optional -20 °C…+70 °C
Storage temperature.....-30 °C…+80 °C, dry
Relative humidity, DIN EN 60068-3-4: 2002 .....98 %, non condensing
Protection class, DIN EN 60529: 1991.....max. IP 65, dependent on the type of connector, or on the connection technology

Mechanical characteristics

Mechanically permissible speed.....≤ 6.000 min^{-1}
Shaft load .....Own mass
Bearing life time.....≥ 3.9 * 10^{10} revolutions at
- Speed.....≤ 3.000 min^{-1}
- Operating temperature.....≤ 60 °C

Shaft diameter in mm 8H7, 10H7, 12H7, 14H7
Permissible angular acceleration .....≤ 10^4 rad/s^2
Moment of inertia.....typically 2.5 * 10^{-6} kg m^2
Start-up torque at 20°C .....typically 2 Ncm
Mass .....typically 0.7 kg

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4.3 Integrated claw coupling

Environmental conditions

Vibration, DIN EN 60068-2-6: 1996.....≤ 100 m/s^2, sine 50-2000 Hz
Shock, DIN EN 60068-2-27: 1995.....≤ 1000 m/s^2, half-sine 11ms
EMC
- Immunity to disturbance, DIN EN 61000-6-2: 2006
- Transient emissions, DIN EN 61000-6-3: 2007

Working temperature.....0 °C…+60 °C, optional -20 °C…+70 °C
Storage temperature.....-30 °C…+80 °C, dry
Relative humidity, DIN EN 60068-3-4: 2002 .....98 %, non condensing
Protection class, DIN EN 60529: 1991.....max. IP 65, dependent on the type of connector, or on the connection technology

Mechanical characteristics

Mechanically permissible speed.....≤ 6.000 min^{-1}
Shaft load .....radial coupling forces
Bearing life time.....≥ 3.9 * 10^{10} revolutions at
- Speed.....≤ 3.000 min^{-1}
- Operating temperature.....≤ 60 °C

Permissible angular acceleration .....≤ 10^4 rad/s^2
Moment of inertia.....typically 2.5 * 10^{-6} kg m^2
Start-up torque at 20°C .....typically 2 Ncm
Mass .....typically 0.7 kg

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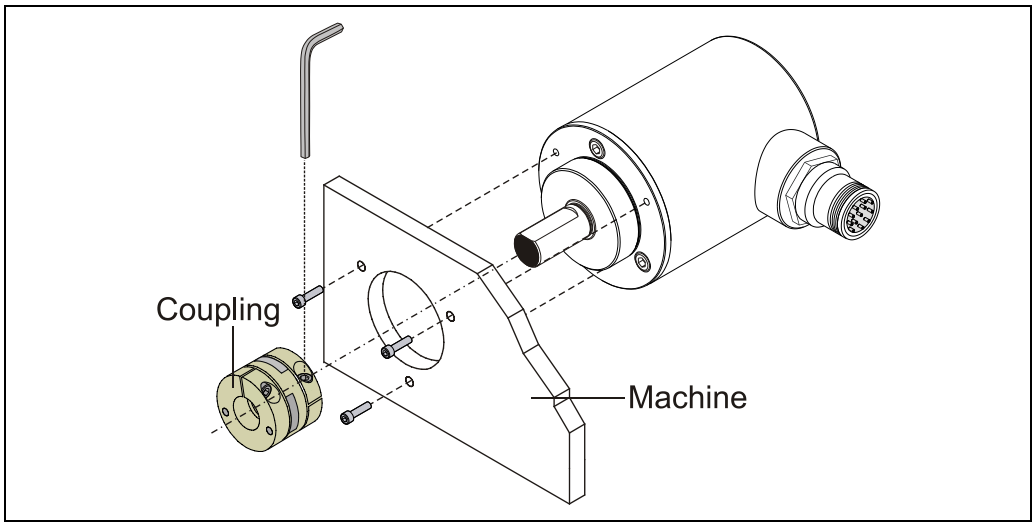
5 Mounting

5.1 Solid shaft

The Measuring systems with solid shaft are connected to the drive shaft via an elastic coupling, which compensates for any deviations in the axial and radial direction between the measuring system and drive shaft. This avoids excessive strain on the bearings.

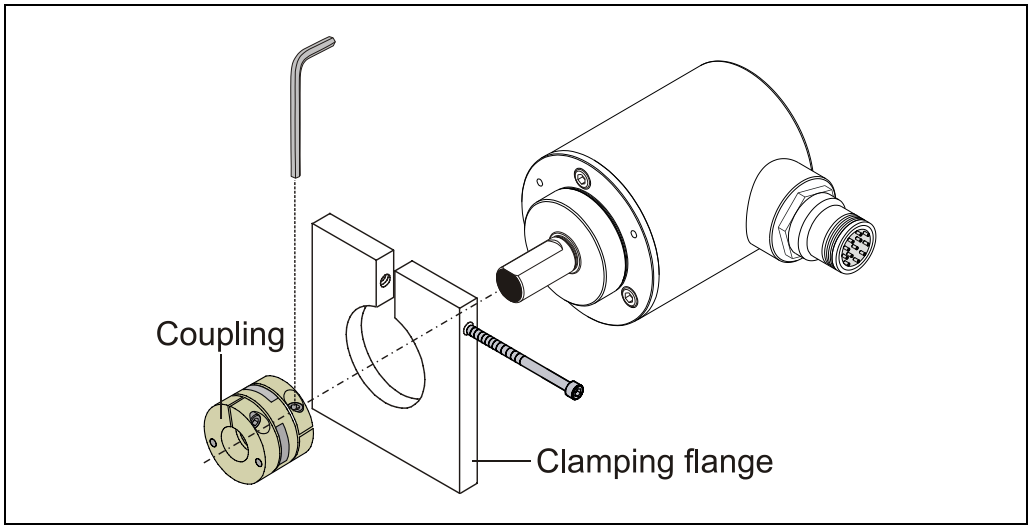
5.1.1 Flange mounting

The centering collar with the corresponding fit centers the measuring system in relation to the shaft. It is fixed to the machine by means of three screws in the flange.



5.1.2 Clamping flange

The centering collar with the corresponding fit centers the measuring system in relation to the shaft. It is fixed to the machine by means of the clamping flange.



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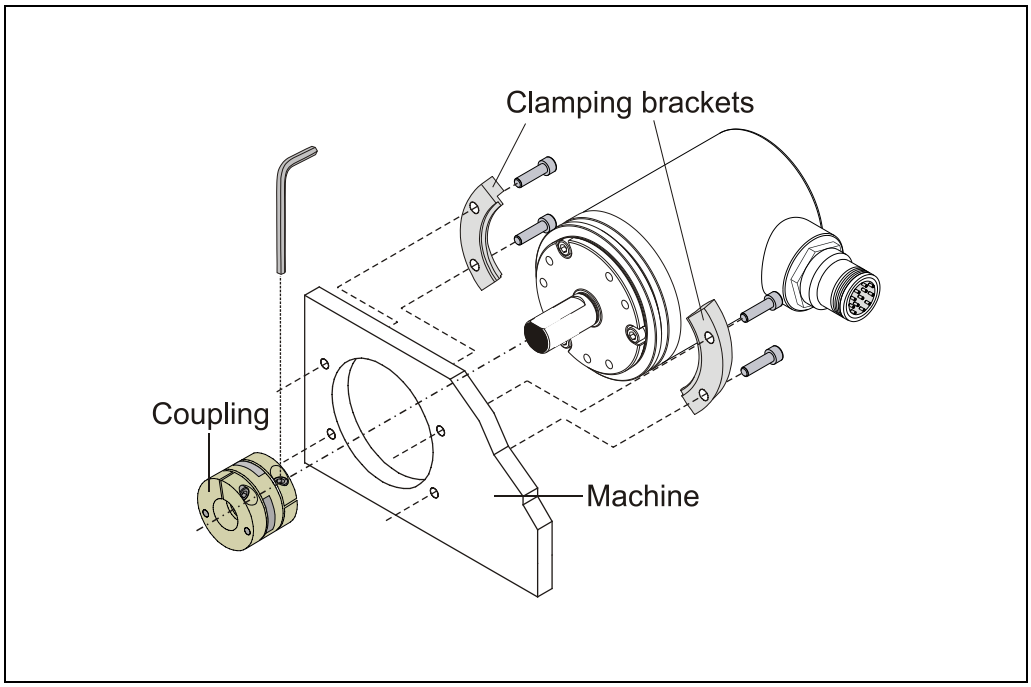
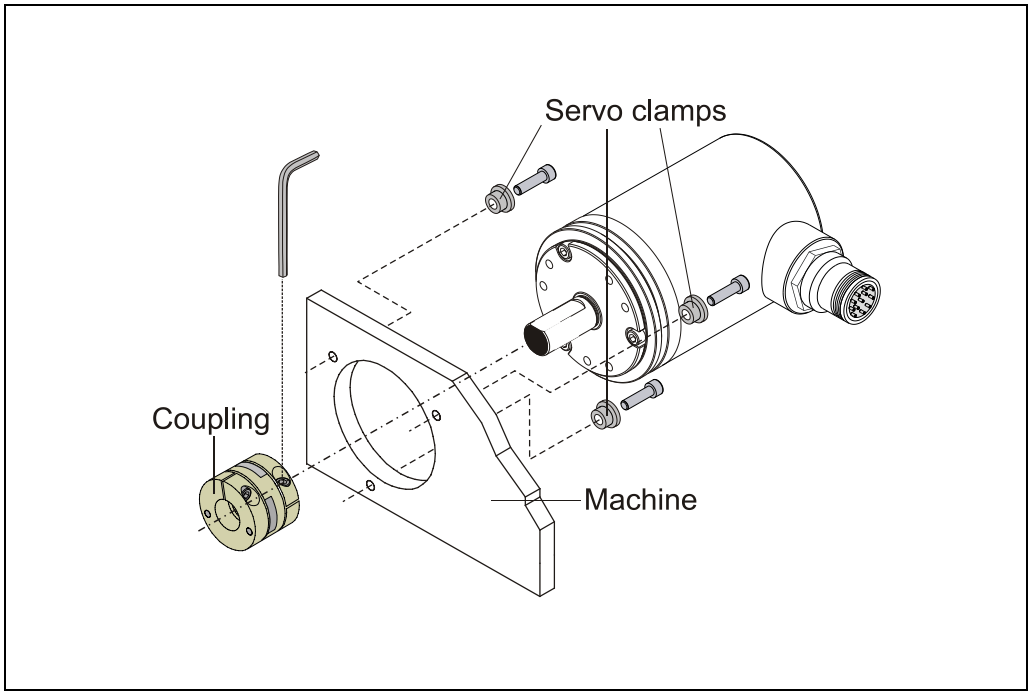
5.1.3 Clamping brackets

The centering collar with the corresponding fit centers the measuring system in relation to the shaft. It is fixed to the machine by means of two clamping brackets which are fastened with four screws.



5.1.4 Servo clamps

The centering collar with the corresponding fit centers the measuring system in relation to the shaft. It is fixed to the machine by means of three servo clamps.



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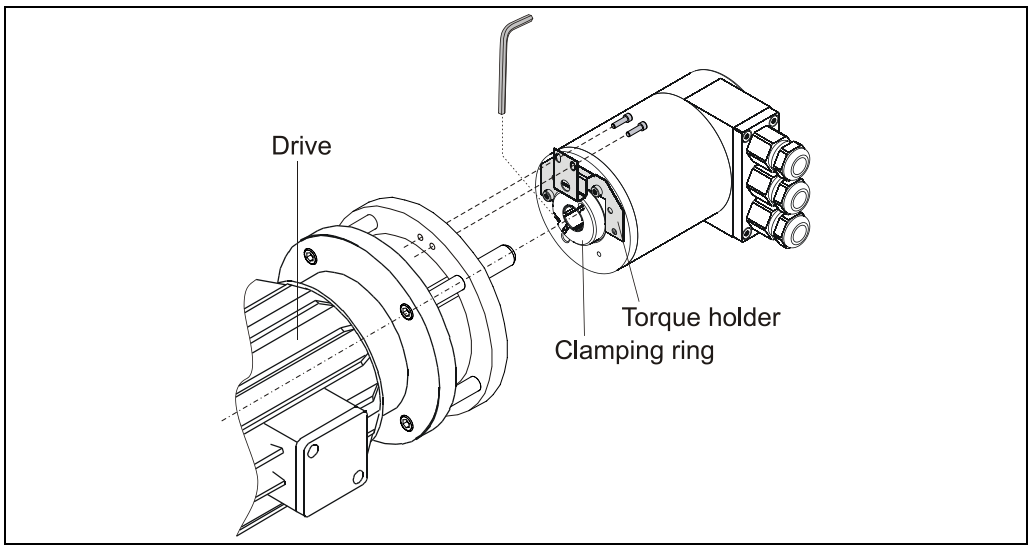
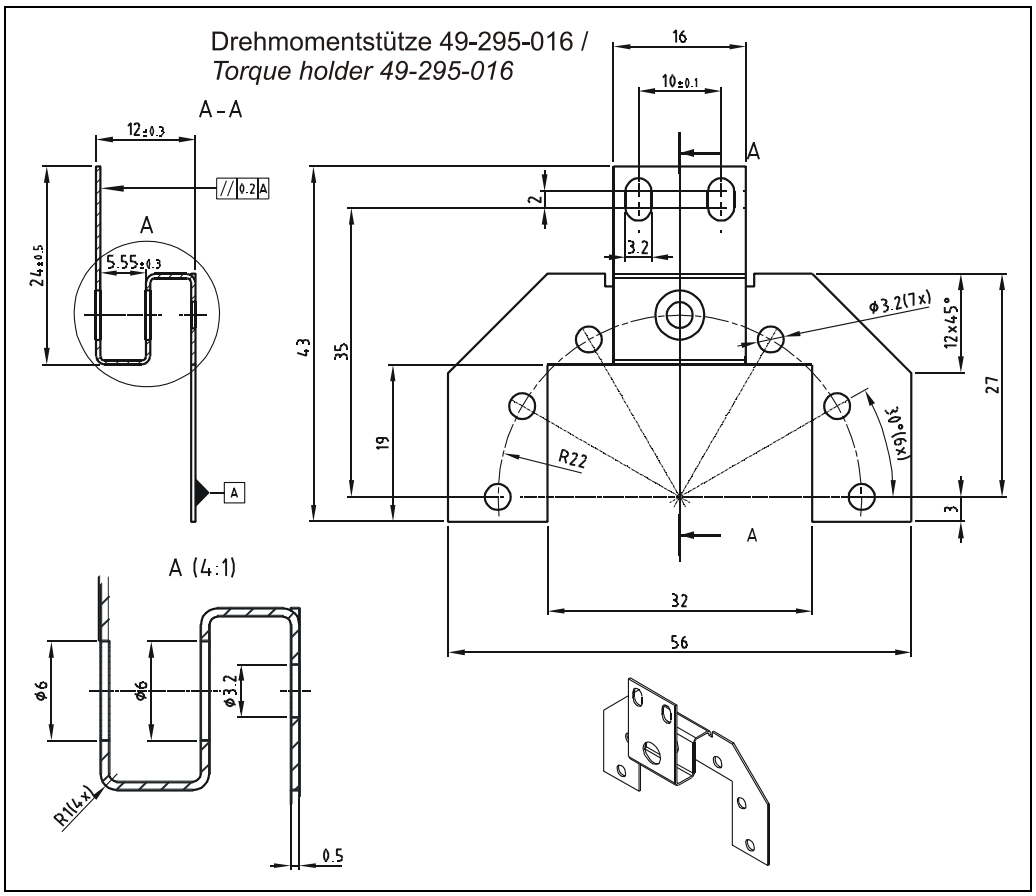
5.2 Blind shaft

5.2.1 Mounting with torque holder

The rotating of the measuring system by the arising torque is prevented by a torque holder. Additionally occurring axial or radial displacements of the drive shaft will be compensated and machine vibrations absorbed.
Mount measuring system with the torque holder by means of two M3 screws onto the drive and protect it against slipping on the shaft by tighten the clamping ring with the hexagon key.





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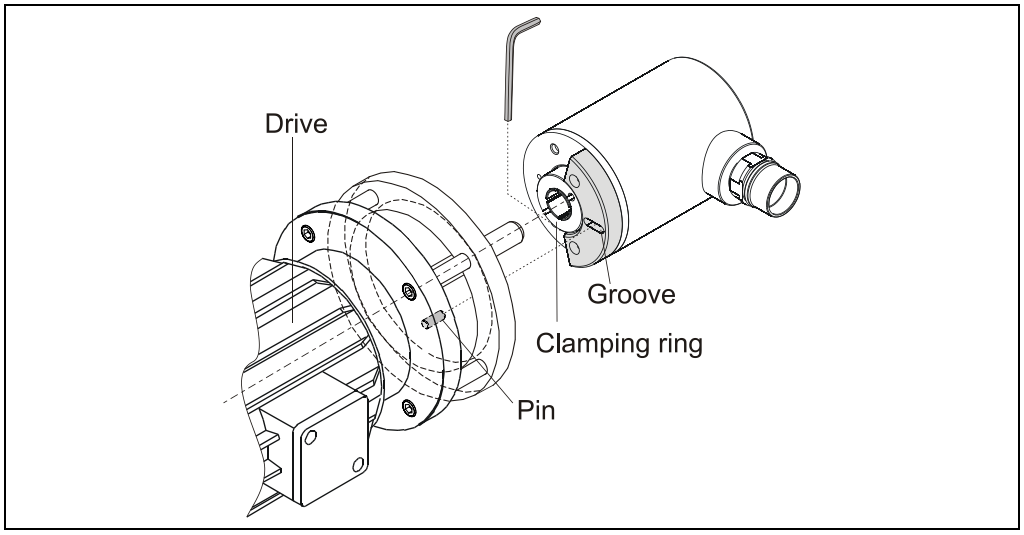
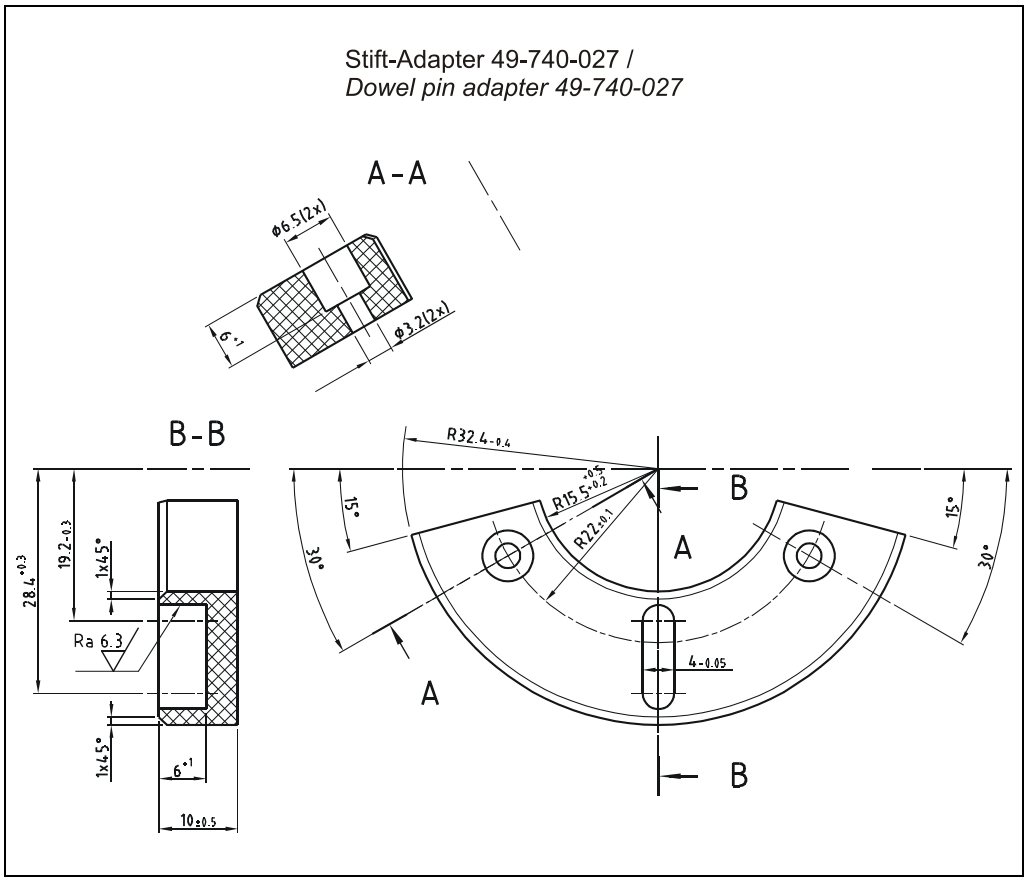
5.2.2 Mounting with pin-groove

The rotating of the measuring system by the arising torque is prevented by a dowel pin on the drive side. For the mounting of the dowel pin the measuring system on the flange side possesses a dowel pin adapter.
This way of mounting shouldn't be used for precision applications. Radial deviations of the shaft can cause an easy torsion of the measuring system and cause thus an angular error.
Protect measuring system against slipping on the shaft by tighten the clamping ring with the hexagon key.





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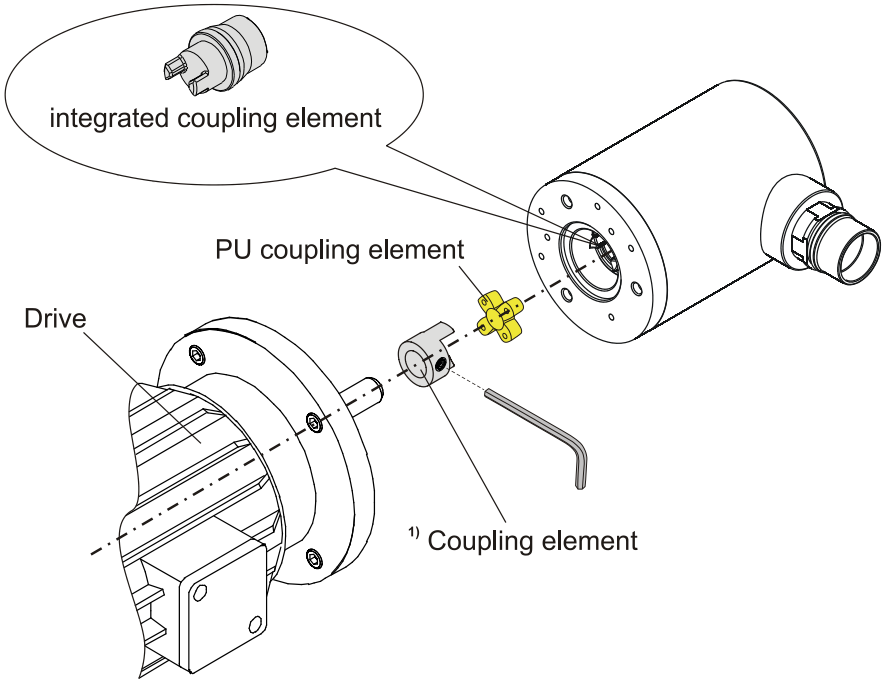
5.3 Integrated claw coupling

5.3.1 Mounting with coupling

Measuring systems with integrated coupling are standalone devices and cannot be produced by remodelling of a standard device with shaft.

Features:

- Short construction length (integrated coupling in the measuring system shaft)
- Simple and fast mounting / dismounting
- Radial and axial tolerance to the customer shaft.
- Only few components necessary



1) not supported, only on request

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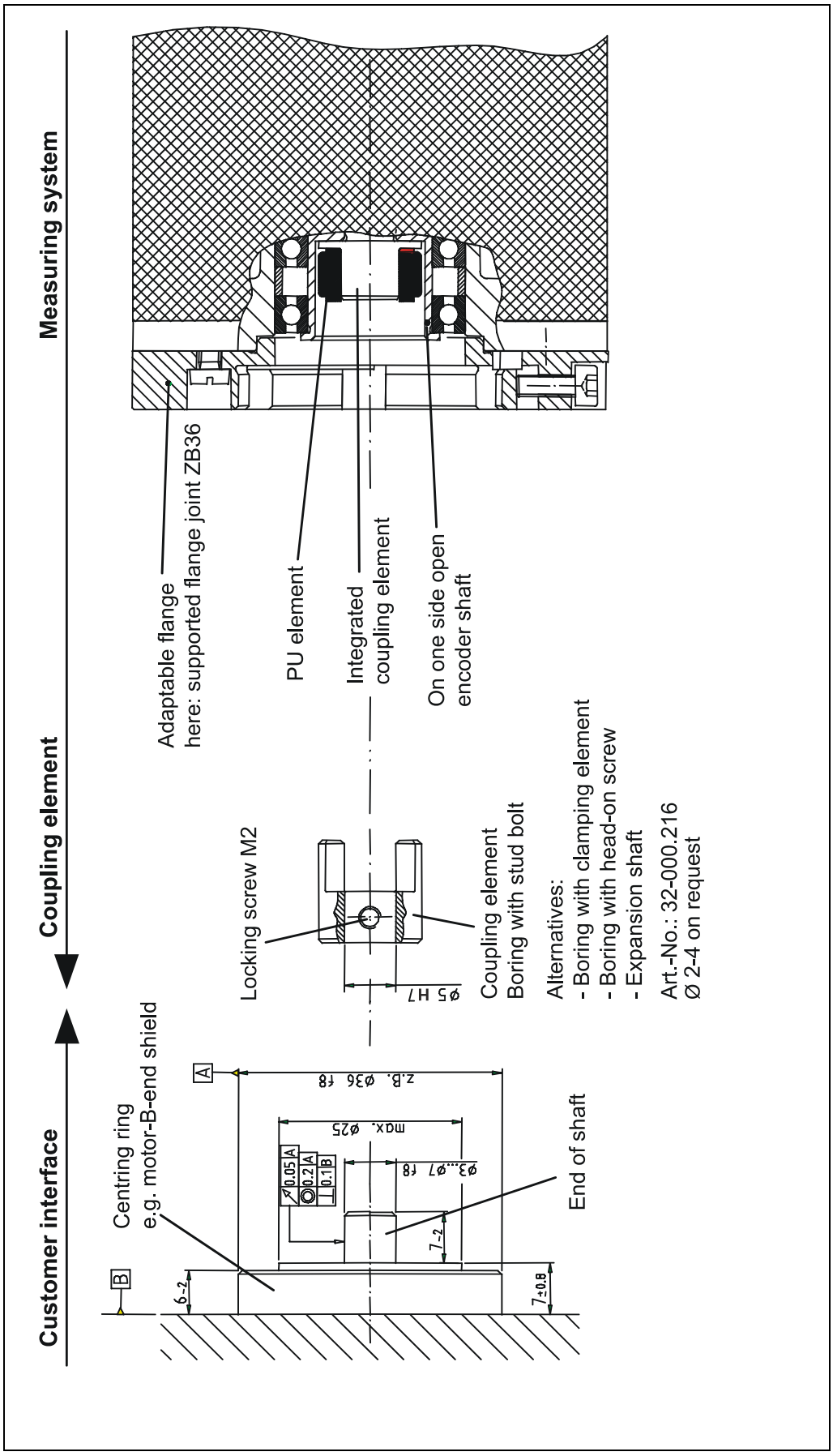
Mounting example



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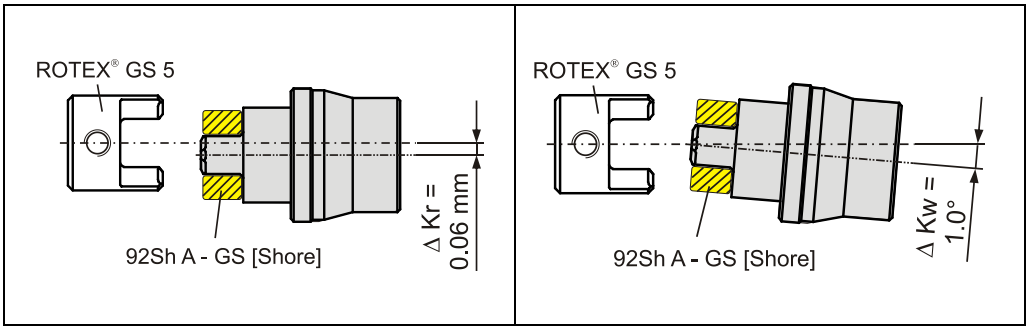
Radial- / angle misalignment

The couplings can take up either a radial (Δ Kr) or an angle misalignment (Δ Kw). Carefully and exactly aligning of the shafts increases the life time of the couplings. The shaft ends which can be connected should be mounted in bearings directly before and behind the coupling. Circulating parts must be protected against unintentionally touching by the user (Safety of machines see DIN EN 292 part 2).



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6 Accessories

490-00101		Info
	Switch cabinet module PT-6	TR-V-TI-GB-0020

490-01001	
	Software- and Support-DVD: - GSD-, EDS-, Type- and XML- Files + Documentations - Programming Software - Driver

490-00105		Info
	Switch cabinet module T-15/2	TR-V-TI-GB-0060

34-000-215 (GS5)	
	ROTEX® spider 92 Shore A (yellow)

490-00310		Info
	USB PC-Adapter V4	TR-E-TI-DGB-0074

34-000-216	
	Hub ROTEX® GS5 AI-H ⌀H7

49-110-xxx		Info
	Clamps and mounting brackets	TR-V-TI-GB-0400

34-000-xxx		Info
	Various couplings	TR-V-TI-GB-0410 TR-V-TI-GB-0420 TR-V-TI-GB-0421 TR-V-TI-GB-0430

85-900-035		Info
	Bearing Module	TR-V-TI-GB-0440

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